Transmission Business Line (TBL)
Available Transfer Capability Methodology

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Table of Contents

A. Introduction

The Bonneville Power Administration ("Bonneville") owns the Federal Columbia River Transmission System ("FCRTS"). Bonneville's Transmission Business Line ("TBL") provides transmission services over the FCRTS under the TBL's Open Access Transmission Tariff ("Tariff") and other grandfathered contracts. The FCRTS is used to deliver power between resources and loads within the Pacific Northwest, and to transmit power between and among the Pacific Northwest region, western Canada and the Pacific Southwest. The FCRTS is comprised of Bonneville's main grid network facilities ("Network"), including constrained paths interconnecting with other transmission systems ("External Interconnections"[1]); Interties;[2] delivery facilities; and generation interconnection facilities.

TBL's Tariff (Attachment C) provides that an Available Transfer Capability ("ATC") methodology will be posted on the OASIS. Increased use, load growth and new generation interconnecting with the FCRTS have caused the TBL to operate the existing Network at or near its physical limits. As a result, the TBL has developed a new methodology, consistent with NERC and WECC criteria, to monitor ATC on internal Network flowgates for long-term service by measuring the impact of proposed transmission requests on such paths. The new ATC methodology combines a planning methodology that measures physical flows on the Network with a contract accounting methodology that reflects contractual rights. The new ATC methodology for long-term service is called the "Combined Planning/Accounting Methodology".

The Combined Planning/Accounting Methodology was developed to establish a single method that TBL will use to determine ATC values on constrained paths internal to the Network ("Network Flowgates") for such needs as system planning, system operations, and transmission marketing. [3] This Network Flowgate approach evaluates transfer capability by monitoring transaction impacts on defined transmission facilities. See Appendix 1 for a map and description of TBL's Network Flowgates.

The Combined Planning/Accounting Methodology will only be used for ATC determinations for the Network Flowgates. The ATC determination for Interties and Network External Interconnections[4] shall continue to use a Contract Accounting Methodology as described in Appendix 2.

B. ATC Methodology for Network Flowgates

A combination of planning studies and Combined contract accounting is used to determine the existing uses of each Network Flowgate. The following is a step-by-step

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[1] Northern Intertie, Malin-Hilltop, West of Hatwai, West of Garrison and LaGrande paths. Although West of Hatwai is a Network Flowgate, it is treated as an external interconnection because its operating characteristics are similar to an external interconnection and this path has historically been treated as such.

[2] Southern Intertie (AC transmission lines and DC transmission lines) and Montana Intertie.

[3] In developing the ATC Methodology for Network Flowgates, TBL held informal consultations with various customer groups participating in open meetings as a part of Contract Lock discussions. For more information see http://www2.transmission.bpa.gov/Business/Customer_Forums_and_Feedback/Contract_Lock/.

[4] Northern Intertie, AC Intertie, DC Intertie, West of Garrison, Reno-Alturas Transmission System, West of Hatwai, LaGrande

explanation of how the Combined Planning/Accounting Methodology is used to calculate ATC for each Network Flowgate.

1. **Determine Total Transfer Capability for Each Network Flowgate.**

   The Total Transfer Capability (TTC) for each Network Flowgate represents the transfer capability of the Bonneville-owned transmission lines and associated facilities comprising such Network Flowgate. See Appendix 3 for determination of TTC for Network Flowgates.

2. **Compute the Contract Accounting ATC.**

   Contract Accounting ATC= TTC – Contract Accounting Flow

   The Contract Accounting ATC Methodology evaluates grandfathered contracts (Formula Power Transmission (FPT), Integration of Resources (IR), and other agreements); Network Integration Transmission (NT); and Point-to-Point (PTP) contracts, and maps their respective impacts on each of the Network Flowgates using the Path Utilization Factors. See Appendices 2 and 5 for Contract Accounting Methodology and Path Utilization Factors, respectively.

3. **Compute the Planning ATC.**

   Planning ATC = TTC – Planning power flow

   Monthly seasonal (January, May, June, August) planning power flows are computed using base case assumptions. See Appendix 6 for power flow base case information.

4. **Compute the Delta between the Contract Accounting ATC and the Planning ATC for each month.**

   Delta = Planning ATC – Contract Accounting ATC

   The Contract Accounting ATC for the months of January, May, June, and August is subtracted from the Planning ATC for the same months to compute the delta, which may result in a negative value. The delta for such month shall determine the delta value for the other months in the corresponding season.[5]

5. **Determine the Combined Planning/Accounting ATC.**

   Combined Planning/Accounting ATC = Contract Accounting ATC + Delta

6. **Determine Transmission Reliability Margin**

   Transmission Reliability Margin (TRM) represents the amount of transmission transfer capability necessary to provide a reasonable level of assurance that the interconnected transmission network will be secure under a broad range of uncertainties. See Appendix 4 for the TRM Adjustment Methodology for each Network Flowgate.

7. **Calculate Final ATC.**

   Final ATC = Combined Planning/Accounting ATC - TRM

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[5] January delta applies November – February; May delta applies April –May; June delta applies to June only; August delta applies July – October. March delta is the average of the January and May deltas.

See Appendix 7 for Final ATC results.

C. Consistency with NERC/WECC ATC Methodologies

The standard NERC/WECC method for computing ATC is given by the equation:

ATC = TTC – Committed Uses

Where Committed Uses = existing transmission commitments + Transmission Reliability Margin

The steps described in Section B can be restated in the following equation:

Final ATC = TTC – Contract Accounting Flow + Delta – TRM

The "existing transmission commitments" component of the NERC/WECC formula is calculated using the contract accounting flows and the delta between the Contract Accounting ATC and the Planning ATC. Hence, the Combined Planning/Accounting ATC Methodology is consistent with the NERC and WECC standard for computing ATC.

D. Modifications to ATC Methodology

The TBL will provide notice and a brief comment period for modifications proposed to the following:

1. The arithmetic formulas described in Section B(3) above used to calculate ATC using the Combined Planning/Accounting Methodology described herein;

2. The methodology for determining load forecasts described in Section 2(b) of Appendix 6; or

3. The generation dispatch levels of federal hydro projects for NT load service described in Section 2(c) of Appendix 6.

Proposed modifications not expressly identified in this Section D will not be subject to such notice and comment.

E. Definitions

Available Transfer Capability (ATC): The available transmission capacity used to describe the inventory on the transmission network available to accommodate additional requests for service.

Flowgate (Cutplane): Transmission lines and facilities owned by Bonneville on a constrained portion of the transmission grid.

Operational Transfer Capability (OTC): The amount of power that can be reliably transmitted through a flowgate given current or forecasted system conditions.

Path: A POR/POD combination.

Path Utilization Factor (PUF): The portion of power that will flow on a particular flowgate as it moves from a specific POR to a specific POD.

POD: Point of Delivery.

POR: Point of Receipt.

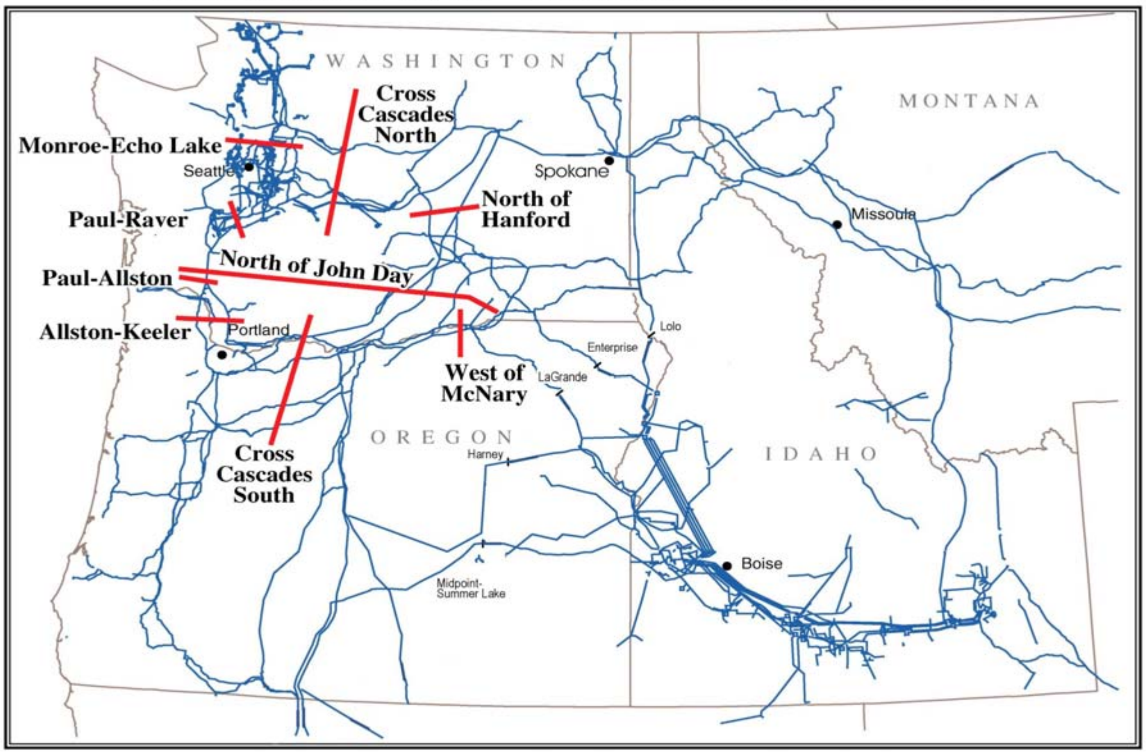
Total Transmission Capability (TTC): TBL's share of a flowgate's transfer capability.

Transmission Reliability Margin (TRM): Margin inserted into ATC calculation to account for nomograms, load forecast error and inherent modeling uncertainty.

Transmission Business Line (TBL)
Available Transfer Capability Methodology

Appendix 1 - TBL Network Flowgate Map and Descriptions

1. Network Flowgate Map.



2. TBL Network Flowgate Descriptions.

   a. Monroe-Echo Lake Flowgate consists of the Monroe-Echo Lake 500kV Line (north to south).

   b. Raver-Paul Flowgate consists of the Raver-Paul 500kV Line (north to south).

   c. Paul-Allston Flowgate consists of the following transmission lines :

      - Napavine-Allston #1 500kV; and
      - Paul-Allston #2 500kV.

   d. Allston-Keeler Flowgate consists of the Allston-Keeler 500kV Line (north to south).

   e. North of Hanford Flowgate consists of the following transmission lines:

      - Hanford-Vantage 500kV; and Grand Coulee-Hanford 500kV.

f. North of John Day Flowgate consists of the following transmission lines:

- Ashe-Marion 500kV;
- Ashe-Slatt 500kV;
- Hanford-Ostrander 500kV;
- Hanford-John Day 500kV;
- Raver-Paul 500kV; and
- Lower Monumental-McNary 500kV.

g. West of McNary Flowgate consists of the following transmission lines:

- Coyote Springs-Slatt 500kV;
- McNary-Ross 345kV;
- McNary-Horse Heaven 230kV; and
- McNary-Santiam 230kV.h.Cross Cascades North Flowgate consists of the following transmission lines:
- Schultz-Raver #1, 2, 3, & 4 500kV;
- Chief Joseph- Monroe 500kV;
- Chief Joseph-Snohomish #1 & 2 345kV;
- Rocky Reach-Maple Valley 230kV;
- Grand Coulee–Olympia 287kV; and
- Columbia-Covington 230kV.

i. Cross Cascades South Flowgate consists of the following transmission lines:

- Big Eddy-Ostrander 500kV;
- Ashe-Marion 500kV;
- Buckley-Marion 500kV;
- Hanford-Ostrander 500kV;
- John Day-Marion 500kV;
- McNary-Ross 345kV;
- Big Eddy-Chemawa 230kV;
- Big Eddy-McLoughlin 230kV;
- Midway-North Bonneville 230kV;
- McNary-Santiam 230kV; and
- Parkdale-Troutdale 230kV.

3. The TBL reserves the right to modify the Network Flowgate designations at any time.

Transmission Business Line (TBL)
Available Transfer Capability Methodology

Appendix 2 - Contract Accounting Methodology

1. Contract Accounting Methodology.

   The Contract Accounting Methodology evaluates individual NT, PTP, and grandfathered contracts (IR, FPT, and other contracts) and maps their respective impacts on each of the Network Flowgates, external interconnections, or Interties using the Path Utilization Factors ("Contract Accounting Flows"). The Contract Accounting Methodology assumes that all contracts are used simultaneously at their full demand or peak monthly forecast for NT contracts, (i.e. no diversity).

   The Contract Accounting Methodology is used to determine ATC for Interties and external interconnections, and to assess the impact of requests for transmission across Network Flowgates in between power flow study cycles. The application of this methodology to Network Flowgates is discussed in Sections 2 through 4 of this Appendix. See Section 5 of this Appendix for special assumptions for Interties and external interconnections.

2. Contract Accounting Methodology Assumptions.

   The Contract Accounting Methodology assumptions include:

   - Limited netting:
     - Some netting across the Network Flowgates of NT and PTP/IR/FPT serving load is used based on historical Light Load Hour data.
     - Contracts not directly serving load (such as contracts delivering to the head of the AC Intertie) are not netted over the Network Flowgates.
   - Non-coincident normal 1 in 2 year monthly peak load forecasts are used for NT contracts.The model used to derive the Path Utilization Factors includes only the Northwest grid, not the entire WECC loop (commonly referred to as a "cut case").

3. Mapping the Impact of Each Contract Across Each Network Flowgate.

   Contract Accounting Flow = POR/POD demand x PUF

   The impact of each contract over each Network Flowgate ("Contract Accounting Flow") is measured by the product of the demand (or load forecast for NT) for each POR/POD combination in the contract times the corresponding PUF for that flowgate. In cases where there are multiple PORs and PODs, the contract demand for PTP, IR or FPT contracts was proportionately allocated to the PORs and PODs as shown in Section 6 below of this Appendix.

   For non-NT POR/POD combinations serving actual load in the Northwest, limited netting for each Network Flowgate is based on a ratio of monthly Light Load Hour to winter Heavy Load Hour.

4. Determine Contract Accounting ATC.

Contract Accounting ATC= TTC – Contract Accounting Flow

To obtain the Contract Accounting ATC, the sum of the Network Flowgate impacts (Contract Accounting Flow), including the netting adjustment described in Section 2 above, is subtracted from the TTC of each Network Flowgate.

5. External Interconnections and Interties.

In applying the Contract Accounting Methodology to Interties and external interconnections, two of the methods' key assumptions are modified. First, no netting of any kind is assumed. Second, the PUF values used in these calculations are either 'zero' or 'one'. Thus, if a transaction has any impact at all on an Intertie or external interconnection, the full amount of the load or contract demand is deducted from the ATC.

6. Multiple POR/POD Evaluation Example.

Some contracts contain multiple PORs and PODs. In order to use the PURs to calculate flowgate flows, the total contract demand must be allocated amon all possible POR/POD combinations. The following is an example of how contract demand for PTP or IR contracts was proportionately allocated in cases where multiple POR/POD combinations were possible.

Multiple to Multiple PTP Example							
Hypothetical Long Term Contract for 2000MW							
	POR	**MW**		**POD**	**MW**		
	A	1000		X	1200		
	B	650		Y	300		
	C	50		Z	500		
	D	300					
		2000			2000		
Allocation of POR Demands to the POD's							
			PODs				
	2000		**X**	**Y**	**Z**		
			1200	**300**	**500**		
PORs	**A**	**1000**	600	150	250		1000
	B	**650**	390	97.5	162.5		650
	C	**50**	30	7.5	12.5		50
	D	**300**	180	45	75		300
			1200	300	500	2000	2000

Transmission Business Line (TBL)

Available Transfer Capability Methodology

Appendix 3 - Determination of Total Transfer Capability (TTC) for Network Flowgates

1. The TBL determines Total transfer capability (TTC) on a seasonal basis for use in long-term ATC calculations. Such TTC calculations are updated on an on-going basis to reflect anticipated near-term system conditions such as planned outages of facilities, near-term load forecasts, generator availability, etc. An initial power flow base case is compiled using expected seasonal operating conditions. The worst contingency outages as defined by the WECC, NERC, and BPA Reliability Standards are studied to ensure equipment loadings, voltage stability, and transient stability performance meet these standards. The TTC limit is determined by adjusting the generation pattern to stress the case to the maximum path flow where the worst-case contingency outages still meet the reliability standards.
2. Network Flowgate TTCs were initially determined based on the Bonneville transmission facilities for each Network Flowgate that existed or were scheduled to be energized by the end of Calendar Year 2004.
3. Due to security considerations, studies used to determine TTC will not be publicly available without prior security clearances.
4. The TBL reserves the right to modify the TTC determinations at any time.

BONNEVILLE POWER ADMINISTRATION

Transmission Business Line (TBL)

Available Transfer Capability Methodology

Appendix 4 - Transmission Reliability Margin Adjustment Methodology & De Minimis Impact Dead-Band

The TRM adjustment methodology is applicable to each Network Flowgate except where special case TRM adjustments are described.

1. TRM Adjustment Methodology.

   a. TRM Adjustment Methodology if Planning ATC is greater than Contract Accounting ATC:

      - If the Planning ATC is greater than the Contract Accounting ATC, a TRM adjustment of 20% of the delta is applied to each Network Flowgate TTC.

   b. TRM Adjustment Methodology if Contract Accounting ATC is greater than Planning ATC:

      - If the Contract Accounting ATC is greater than the Planning ATC, there will be no TRM adjustment to that Network Flowgate TTC.

2. Special Case TRM Adjustments.

   a. Raver-Paul Flowgate (netting adjustment):

      For spring and summer seasons[6], a TRM adjustment is made to such flowgate to account for generation displacement (assumes one (1) unit each at Centralia and Chehalis are off-line during this time period). TRM for such flowgate will be adjusted as follows:

      - The TRM adjustment for the Raver-Paul Network Flowgate for the spring and summer seasons shall be a minimum of 300 MW.
      - For seasons other than spring and summer[7], the TRM methodologies described in Section 1 of this Appendix shall apply.

   b. Cross-Cascades North and South (extreme weather adjustment):

      - For the winter season, 1 in 20 loads are assumed in the computation of ATC and no TRM adjustment is made.
      - For seasons other than winter, the TRM methodology described in Section 1 of this Appendix shall apply.

   c. North of John Day:

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[6] Spring and summer seasons: Months of March – October.

[7] Seasons other than spring and summer: Months of November - February

- The TRM adjustment for the North of John Day nomogram shall be a minimum of 200 MW in all months.
- In addition, if the Planning ATC is greater than the Contract Accounting ATC, then an additional TRM equal to 20% of the Delta shall be included.

3. De minimis Impact Dead-Band.

   For each transmission request using a Network Flowgate where the PUF value is less than or equal to 10% **and** the resulting impact on the flowgate is less than or equal to 10 MW, then the transmission request will be deemed to have a de minimis impact on that Network Flowgate, and the impact on that flowgate will be ignored. ATC over that Network Flowgate will not be decremented for that transaction. Between ATC updates, the yearly total for all transmission requests with de minimis impacts on a Network Flowgate ATC that will be ignored will not exceed 2% of the TTC over such Network Flowgate **or** 50 MW, whichever is less.

4. The TBL reserves the right to modify the TRM and dead-band methodologies at any time.

Transmission Business Line (TBL)
Available Transfer Capability Methodology

Appendix 5 - Path Utilization Factors (PUF)

Path Utilization Factors may be found at:

http://www2.transmission.bpa.gov/Business/Customer_Forums_and_Feedback/Contract_Lock/Documents/10-17-03NewPUFTablesCutSystem.xls

BONNEVILLE POWER ADMINISTRATION

Transmission Business Line (TBL)

Available Transfer Capability Methodology

Appendix 6 - Power Flow Base Case

1. Power Flow Model.
   a. The power flow model is a mathematical representation of the actual lines, transformers, loads, and generators that comprise the power system. A key output of this model is a computation of how much power will flow over each element in the power system for the assumed load and generation levels.
   b. For the initial planning ATC calculations, power flows representing projected 2004 system conditions were modeled. Subsequent analysis will use base cases that reflect new or changed power system conditions, particularly the addition of major new transmission facilities.
   c. Intertie flows were adjusted to model firm transmission rights on the Interties.
   d. The power flows over Network Flowgates were identified.
   e. The difference between the power flow and the TTC becomes the Planning ATC for the flowgate. One Planning ATC is established per flowgate, per season.
2. Power Flow Base Case Assumptions.
   a. Representative power flow cases were developed for four seasons—winter, spring, early summer, and late summer/fall.
   b. Normal peak (I in 2 year) load forecasts were used for all seasons. For the winter season, an additional power flow base case using extra heavy loads (1 in 20 year) was developed.
      1. Load forecasts for utilities that perform their own forecasts were obtained from such utilities as part of the TBL's standard process for base case development.
      2. Load forecasts for utilities that do not do their own load forecasts were based on forecasts developed by the TBL.
   c. Federal generation levels were set using a multiple step process. The Columbia Generating Station (formerly known as WNP-2) was assumed to be on-line at full load in the power flow cases in all seasons (in the Contract Accounting Methodology, however the plant was assumed to be off-line for maintenance during the months of April and May in the odd-numbered years). The portion of the plant's output that was not covered under federal PTP contract demand was deemed to serve all contracts that call out non-specific federal hydro projects as PORs.

Generation levels at each of the federal hydro projects[8] were set by first determining each project's 90th percentile generation value by month for the period 1997 – 2002. The 90th percentile value means each such project was at or below these generation levels 90% of the time during the given month. Generation levels at the Libby, Hungry Horse, Dworshak, and Albeni Falls projects, however, were set based on the requirements set forth in the 2002 Biological Opinion. In addition, the generation levels at the Willamette Valley projects were set at the minimum levels seen by season during Calendar Year 2001 as shown below:

Willamette Valley Projects 2001 Generation Seasonal Averages[9]

	Winter	Spring	Summer	Fall
Big Cliff	8	15	3	3
Cougar	8	14	11	14
Detroit	40	44	48	31
Dexter	4	10	0	0
Foster	7	12	4	7
Green Peter	28	24	23	23
Hills Creek	8	8	10	7
Lookout Point	35	45	38	23
Lost Creek[10]	15	24	21	10
Sum	153	196	158	118

The generation at the federal hydro projects was then scaled to match the sum of the demands for all contracts that call out non-specific federal hydroelectric projects as PORs after adjusting these demands for the portion served by Columbia Generating Station, Libby, Hungry Horse, Dworshak, Albeni Falls, and the Willamette Valley projects. The federal PTP demands at each project were then added to this result to obtain the final assumed generation level for each federal hydro project. This overall method for modeling the federal resources is referred to as the "Modified 90th Percentile Method" and is used in both the power flow base cases and Contract Accounting Methodology.

d. Generation levels at the non-federal Mid-Columbia hydro projects were set at 90% of their historical output by season.

[8] Federal hydro projects include: Grand Coulee, Chief Joseph, Dworshak, Albeni Falls, Libby, Hungry Horse, Lower Granite, Lower Monumental, Little Goose, Ice Harbor, McNary, John Day, The Dalles, Bonneville, Willamette Valley Projects.

[9] Calendar Year 2001 was used because its averages were the lowest of the last 6 years. Winter: December – March; Spring: April – May; Summer: June – September; Fall: October – November.

[10] Most recent data for Lost Creek is 1996. Data between 1996 and 2001 for Hills Creek and Lookout Point followed a pattern that was applied to Lost Creek's 1996 data to arrive at numbers used here. Hills Creek and Lookout Point were used as models due to their regional proximity to Lost Creek.

e. Non-federal thermal generators requiring transmission service on the federal transmission system were set at either their contract demand or seasonal capability, whichever was lower.

f. Non-federal resources that do not require transmission service from the TBL were set at levels obtained from such resource owners as part of the TBL's standard process for power system planning studies.

g. A summary of power flow assumptions may also be found at:

http://www2.transmission.bpa.gov/Business/Customer_Forums_and_Feedback/Contract_Lock/Documents/10-16-03BaseCaseResults.pdf

3. Determining Planning ATC.

The power flow base cases for each season were run using the assumptions described in Section 2 of this Appendix. The resulting flows across each Network Flowgate ("Planning Power Flow") were obtained and compared to each flowgate's TTC. The difference between the flowgate TTC and the Planning Power Flow is the "Planning ATC".

4. Parallel Flows.

The Network Flowgates do not represent all transmission lines across the cutplanes. In the Planning power flow studies for determining Planning ATC and TTC for the Network Flowgates, the TBL accounts for power flow across Bonneville facilities only. The flows on all facilities for several cutplanes follow. The information contained in the following is not intended to establish a formal allocation between the TBL and other transmission owners.

Flow Gate	CASE				
	MAY04M3 (MW)	JUN04M3 (MW)	A04M3 (MW)	J04M3 (MW)	J04EHM3 (MW)
West of McNary	2678	2595	2384	1897	1783.6
Coyote Springs - Slatt 500 kV	1876	1811	1647	1189	972.4
McNary - Ross 345 kV	291	280	257	379	447.2
McNary - Horse Heaven 230 kV	319	320	302	162	191.5
McNary - Boardman Tap 230 kV	192	184	178	167	172.5
South of Allston	2721	2748	2720	873	212.5
Allston - Keeler 500 kV	1477	1516	1533	149	-186.5
Lexington - Ross 230 kV	304	269	262	167	95.6
Allston - St. Helens 115 kV	79	81	80	42	
Astoria - Seaside 115 kV	66	66	68	46	42.9
Trojan - St Mary's 230 kV	304	309	304	132	82.6
Trojan - Rivergate 230 kV	245	257	252	85	65.4
Merwin - St. Johns 115 kV	155	163	131	150	112.5
Clatsop - Lewis & Clark 115 kV	91	87	90	102	

Flow Gate	**CASE**				
	MAY04M3 (MW)	**JUN04M3 (MW)**	**A04M3 (MW)**	**J04M3 (MW)**	**J04EHM3 (MW)**
South of Napavine	2026	2051	2139	580	678.9
Napavine - Allston #1 500 kV	1039	1051	1094	339	395.7
Paul - Allston #2 500 kV	987	1000	1045	241	283.2

Notes: (a) The "from" and "to" substations are listed in the direction of positive flow; (b) the underlined substation is where the flow is metered; and (c) numbers are rounded.

5. The TBL reserves the right to modify the Planning ATC at any time.

Transmission Business Line (TBL)
Available Transfer Capability Methodology

Appendix 7 – Final ATC Results